

A 2.5K GM/J-T Cooler for Maser Low-Noise Amplifier Cooling

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A 2.5K cooler intended for microwave Maser low-noise amplifier cooling applications is described. Maser amplifiers are used as low-noise amplifiers in the National Aeronautics and Space Administration (NASA) Deep Space Network ground communication systems. The performance of Maser amplifiers improves dramatically by reducing the operating temperature from the current 4.5K operating temperature to 2.5K. The device combines a 4K Gifford-McMahon (GM) refrigerator with a J-T circuit to provide 180 milliwatts of cooling at 2.5K. The device is compact and can operate in any physical orientation. A commercial two stage GM cooler pre-cools the Helium JT circuit flow. The J-T circuit can be simplified compared to existing systems. The 4K GM stage allows the JT circuit helium to be cooled below saturation temperature before the J-T expansion. Only two counter flow heat exchangers are necessary. The lower GM operating temperature also allows the use of a single stage compressor for the JT. The J-T operates with a supply pressure of only 200 kPa. A commercial scroll vacuum pump is used as a compressor. The simplified system can be fabricated for less than half the cost of current 4.5K Maser coolers.